格子歪みの異なる高エントロピー合金引張変形した後の残留歪みと集合組織評価

Residual strain and texture evaluation for high entropy alloys with different initial lattice distortions after various tensile deformation

方　偉[1)]　　徐　平光[2)]

Wei FANG[1)]　　Pingguang XU[2)]

[1)]河北工業大学　　[2)]原子力機構

Abstract: The investigation of tensile deformation texture evolution in high entropy alloys (HEAs) with various initial lattice distortions holds great significance for their potential industrial applications, and it remains an open question. In this study, the deformation texture evolution of HEAs containing interstitial carbon was examined through complementarily using the neutron diffraction and electron backscatter diffraction (EBSD) techniques. Additionally, the microstructure observation was carried out to gain insights into the texture evolution mechanism during tensile deformation. This research helps to elucidate the influence of lattice distortion resulting from interstitial atoms on the evolution of deformation texture.

Keywords：neutron diffraction, texture analysis, high entropy alloys, microstructure evolution

１．Research Purposes

The experimental study will provide valuable insights into the significance of lattice distortion on texture evolution in carbon containing HEAs. This research will further explore the possibilities for expanding the range of polycrystalline materials that can benefit from the angle dispersive neutron diffraction at JRR-3.

２．Experimental Procedures

The tensile deformation textures of CoFeMnNi alloys, both with and without carbon, were measured using RESA neutron diffraction at JRR-3. In addition, conventional microstructure analysis techniques such as transmission electron microscopy (TEM) and electron backscatter diffraction (EBSD) were here employed complementarily. The neutron diffraction results were analyzed using the MAUD texture software.

３．Results and discussion

The results obtained from neutron diffraction clearly demonstrate distinct texture evolution in the presence and absence of interstitial carbon. The inclusion of carbon leads to the development of more pronounced Goss and Brass textures during deformation. Microstructure observations reveal a shift in the dislocation motion pattern from wavy slip to planar slip due to the presence of carbon, resulting in the formation of additional slip bands. In future studies, the combined application of neutron diffraction and conventional microstructure analysis techniques such as TEM and EBSD holds great potential. This approach will contribute to expanding our understanding of the tensile deformation texture in high entropy alloys (HEAs) through the utilization of neutron diffraction at JRR-3.

４．References

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